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Crustacea (Isopoda, Anomura, Brachyura) del Cretácico de la región de Soh (NW de Isfahán) Irán Central

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ABSTRACT

The second fossil isopod from Iran is herein reported. Additional specimens of the small lobster *Huhatanka iranica* Bahrami and Vega *in* Yazdi *et al*. (2010) are also revised. The aforementioned allows differentiating this species from the only other known species, *H. kiowana* (Scott, 1970) from the Albian of Kansas, USA. Some indeterminate callianassoids, found associated with the isopod and *H. iranica*, are also reported.

Keywords: Crustacea, Isopoda, Decapoda, Albian, Isfahan, Iran.

RESUMEN

Se reporta el segundo registro de isópodo fósil para Irán, así como varios ejemplares complementarios de la langosta Huhatanka iranica Bahrami y Vega en Yazdi et al. (2010), lo cual permite diferenciar a esta especie de la otra especie del género, H. kiowana (Scott, 1970) del Albiano de Kansas, USA. Algunos callianassoideos, asociados al isópodo y H. iranica, son reportados.

Palabras clave: Crustacea, Isopoda, Decapoda, Albiano, Isfahán, Irán.

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1. Introduction

Cretaceous crustaceans from Iran are relatively scarce and have been reported by Feldmann *et al*. (2007), Yazdi *et al*. (2009, 2010), and McCobb and Hairapetian (2009). The present contribution reports the first isopod from late Albian deposits of central Iran, represented by a single, posterior molt specimen, attributed to *Natatolana* sp. Additional specimens of the mecochirid *Huhatanka iranica* Bahrami and Vega in Yazdi *et al*. (2010), from the late Albian of Soh area, allow describing some morphological details lacking in the first report by Yazdi *et al*. (2010). These new specimens are compared with the type specimens of H. *kiowana* (Scott, 1970) from the Albian of Kansas, described by Feldmann and West (1978).

2. Geology and stratigraphy

The Iranian Plate, a major segment of the Cimmerian microcontinent, had detached from northeastern Gondwana by the end of Permian and collided with the Turan Plate (part of Eurasia) towards the end of the Triassic (Sengore, 1990; Stampfli *et al*., 1991; Saidi *et al*., 1997; Mirnejad *et al*., 2013). From the Early Jurassic to Senonian, the young Neo-Tethyan oceanic basin was reduced in extent by its subduction under the Iranian continental plate. The final closure of the Neo-Tethys, marked by the collision between the Iranian and Arabian plates, took place during the Neogene (Berberian *et al*., 1982; Shahabpour, 2005; Ahmadi Khalaji *et al*., 2007). The Iranian plateau is divided into several zones from SW to NE (Figure 1): Zagros fold-thrust belt, Sanandaj–Sirjan metamorphic zone, Urumieh–Dokhtar volcanic belt, central Iran zone, Alborz zone, Kopeh Dagh zone, and Eastern Iran zone (Falcon, 1967; Stocklin, 1968; Dewey *et al*., 1973; Stocklin and Nabavi, 1973; Jackson and McKenzie, 1984; Sengore, 1984; Byrne *et al*., 1992; McCall, 2002; Blanc *et al*., 2003; Alavi, 2004; Walker and Jackson, 2004).

The study area is located in Central Iran (Figure 1). Following the late Cimmerian orogeny, the Early Cretaceous sea advanced onto the small continent of Central Iran, the transgression in the Soh area began in the late Barremian and continued to the early Albian (Zahedi, 1973). A sequence of thick sediments eroded by this uplift included several lithologies such as red conglomerate, sandstones, and limestones (Yazdi *et al*., 2010). *Orbitolina gray* limestones with marl intercalations are late Aptian in age (Khodaverdi *et al*., 2016) (Figures 2 and 3). Shales with intercalations of limestone contain ammonites, green to gray marly limestone with nodules that include *Huhatanka iranica*, the here described isopod, small turritellid gastropods; and nuculid bivalves (De Grave, 2009). Thick, micritic Turonian limestones overlie the crustacean beds (Figure 3). The youngest sequence (Eocene and Oligo-Miocene, Qom Formation) can be observed anywhere in the plain (Khodaverdi *et al*., 2016). An angular unconformity is present between the

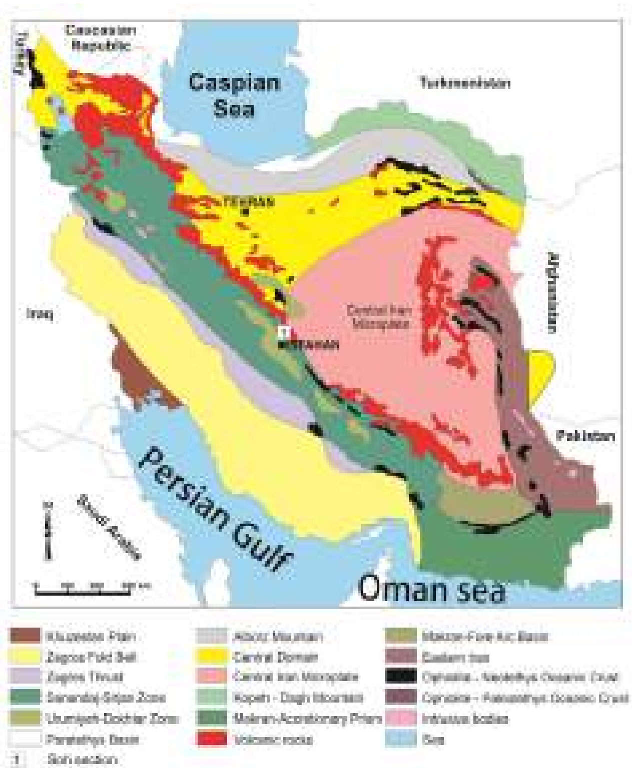

Figure 1 Structural map of central Iran (modified from Bahrami *et al*., 2018).

Pliocene and the Pleistocene (clastic and travertine), and different ages below this sequence can be traced throughout the area. This angular unconformity is a result of the final alpine orogenic phase. The studied section (Figures 3, 4) is located near the village of Soh (70 km northwest of Isfahan) and is accessible by a 35 km unpaved road off the Isfahan–Tehran highway. The section is on the right side of a seasonal river valley. Coordinates for the fossil locality are N 33°27′9″, E 51°28′32″. Structurally, the locality belongs to the Central Iran microplate, which is restricted by the NW–SE Sanandaj-Sirjan metamorphic belt to the west, and by the Great Kavir fault to the East.Specimens reported here are held in the Department of Geology, Faculty of Sciences, University of Isfahan, 81746, Iran, under acronym IUMC, and in the paleontological collection of Kent State University (KSU), Kent, Ohio (USA).

Abbreviations: *a* = branchiocardiac groove, *ac* = antennal carina, *b* = antennal groove, *b1* = hepatic groove, *c* = postcervical groove, *cd* = cardiac groove, *e1e* = cervical groove, *en* = endopod, *ex* = exopod, *gc* = gastro-orbital carina, *mc* = median carina, *oc* = orbital carina, *P1-P5* = pereiopods 1-5, *s1-s6* = pleonal somites (i-v in Figure 5), *Te* = telson, *VII-V* = pereonal somites in Figure 5.

3. Systematic palaeontology

Class Malacostraca Latreille, 1802
Order Isopoda Latreille, 1817
Suborder Cymothoida Wägele, 1989
Family Cirolanidae Dana, 1853
Genus *Natatolana* Bruce, 1981
Type species: *Cirolana hirtipes* H. Milne Edwards, 1840, by original designation, not

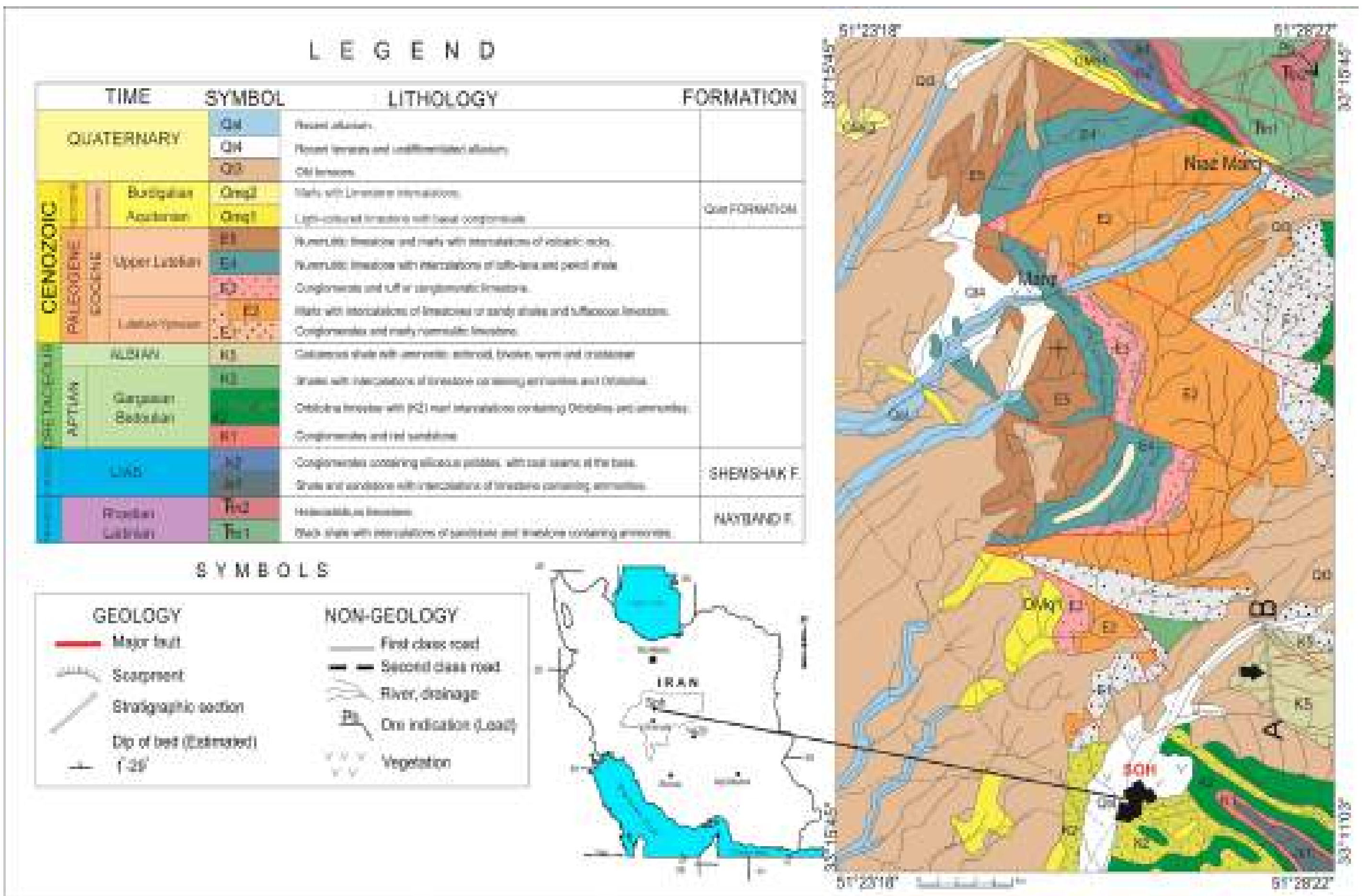

Figure 2 Location and geologic maps of the study area with position of fossil locality (arrow), northwest of Isfahan, Iran.

subsequent designation as stated by
Brusca *et al*. (1995).

Natatolana sp.
Figure 5A to 5C

Description: Small posterior exuvia, smooth, preserving pereonites V–VII, pleonites i–v, pleotelson, left pereopod 7 and uropods. Pereonites V–VII semirectangular, represent less than half the maximum length and maximum width, all of about same length and width. Pleon represents about one third the maximum length and about two thirds the maximum width; pleonites with triangular, acute posterolateral margins. Pleotelson sub-triangular, two-thirds the maximum length and half the maximum width, with rounded posterior margin. Left pereopod 7 incompletely preserved, only propodus and acute dactylus. Uropods wide, peduncle apparently narrow; exopod narrow, lanceolate, about half the length of endopod and one-third its maximum width; margins smooth; endopod wide, subovate, rounded margins, extend to level of posterior tip of pleotelson.

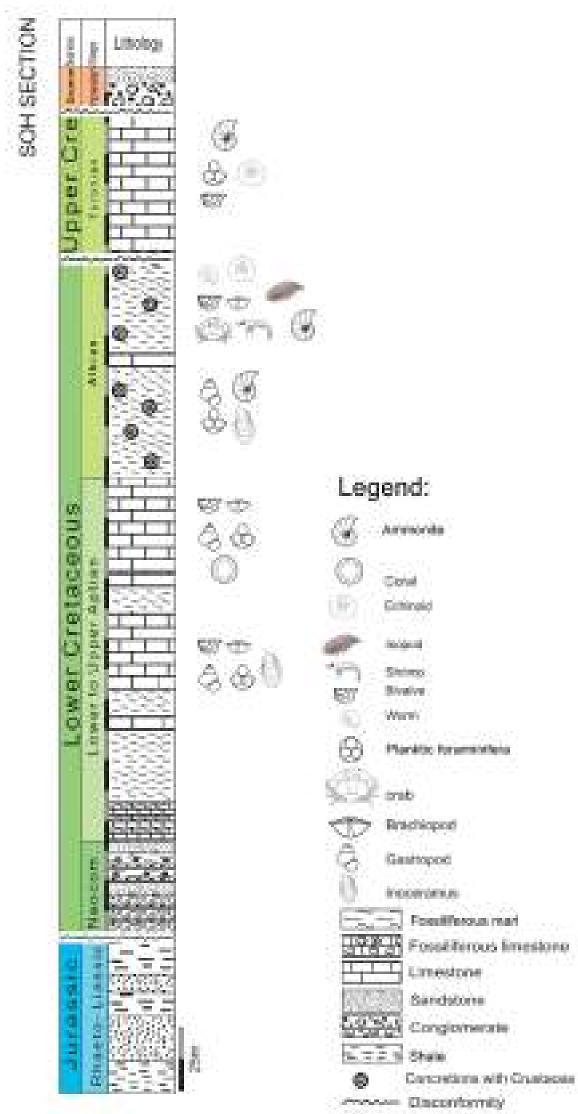

Figure 3 Stratigraphic section of the study area, indicating position of reported specimens.

Material: One specimen, IUMC-100.

Measurements: length = 15.3 mm, width = 9.4 mm.

Discussion: The specimen represents the second record for a fossil isopod from Iran. Recently Hyžný *et al*. (2019) reinterpreted crustacean remains thought to be lobster remains from the Early Cretaceous of Iran (Feldmann *et al*., 2007). Other similar cirolanid representatives reported from Cretaceous, Paleogene, and Neogene deposits around the world include *Cymothoidana websteri* Jarzembowski *et al*. (2014) from the Hauterivian-Barremian of China, Spain, and the United Kingdom. More recently, Vega *et al*. (2019) reported undetermined cirolanid isopods from the Early Cretaceous of Puebla, Mexico, associated with posterior exuviae of *Natatolana poblana* Bruce and Vega (2019, in Vega *et al*., 2019), which differs from the studied specimen in having smaller and narrower uropods. Additional and more complete Iranian specimens could confirm if they represent a new or already known species of *Natatolana*.

Order Decapoda Latreille, 1802
Suborder Pleocyemata Burkenroad, 1963
Infraorder Glypheidea Zittel, 1885
Superfamily Glypheoidea Zittel, 1885
Family Mecochiridae Van Straelen, 1924
Genus *Huhatanka* Feldmann and West, 1978

Type species: *Squilla*? *kiowana* (Scott, 1970), by subsequent designation of Feldmann and West (1978).

Huhatanka iranica Bahrami and Vega *in*
Yazdi *et al*., 2010
Figures 6A, 6B, and 7

Huhatanka iranica Bahrami and Vega *in* Yazdi *et al.* (2010), p. 209, fig. 3.1–3.4.

Emended diagnosis: Small mecochirid, cephalothorax elongate, longer than high; posterior margin rimmed, curved; surface uniformly granulate; rostrum triangular, short; relatively weak median carina with fine tubercles extending from posterior portion of rostrum to cervical groove; a pair of parallel carinae extend from the lateral sides of rostrum to cervical groove; antennal region one-third carapace length, with three longitudinal carinae; cervical groove deep; oblique weak carina extends from dorsal portion of carapace on lower portion of cervical groove; postcervical, branchiocardiac, and hepatic grooves shallow; cardiac groove slightly deep; tubercles become finer on posterolateral side of carapace; s1 covered by granules; P1 slightly longer than P2-P5.

Emended description: Mecochirid of small size; carapace elongate, maximum height two thirds of maximum length, posterior margin rounded, rimmed, surface covered by relatively uniform tubercles; rostrum acute, triangular, bordered by finely granulate ridges that extend posteriorly to cervical groove; weaker median ridge also extends from tip of rostrum to cervical groove; antennal region one third the carapace length, with three granulate longitudinal carinas, middle and lower carinas stronger; cervical groove deep, inclined toward anterolateral margin; oblique weak ridge extends from dorsal portion of carapace to lower portion of cervical groove; branchiocardiac, hepatic and postcervical grooves shallow and parallel; cardiac groove slightly deep; tubercles become finer on posterolateral side of carapace, s1 and s2 similar size and shape; surface covered by granules; P1 longer than P2-P5, P2-P5 similar size an length.

Material: IUMC-101 to IUMC-105.

Measurements: IUMC-101, length = 61.2 mm, width = 8.9 mm; IUMC-102, length = 53.1 mm, width = 7.9 mm; IUMC-103, length = 42.3 mm, width = 7.8 mm; IUMC-104, length = 55.5 mm, width = 10.9 mm; IUMC-105, length = 38.8 mm, width = 8.7 mm

Discussion: The specimens confirm the differences previously suggested by Yazdi *et al.* (2010) between *Huhatanka iranica* and *H. kiowana* (Scott,

Figure 4 Panoramic view of the Albian greenish shales with nodular concretions containing Crustacea.

1970). It is clear that the specimens from the Albian of Iran have a more granulose carapace and pleonal surface, showing some morphological features as branchiocardiac, cardiac, and postcervical grooves not previously recognized by Yazdi *et al*. (2010).

Some of these features were considered weak or absent by Feldmann and West (1978) in their description of the genus. However, the specimens illustrated in Figure 6E to 6H show weakly the morphological features previously mentioned. According to Schweitzer *et al*. (2010) seven genera, *Huhatanka* (Feldmann and West, 1978), *Jabaloya* (Garassino *et al*., 2009), *Mecochirus* (Germar, 1827), ?*Praeatia* (Woodward, 1868), *Pseudoglyphea* (Oppel, 1861), ?*Selenisca* (Meyer, 1847), and *Meyeria* (M'Coy, 1849), now *Atherfieldastacus* (M'Coy, 1849) belong to the Mecochiridae Van Straelen, 1924.

However, Charbonnier *et al*. (2013) considered *Selenisca* as a junior synonym of *Glyphea*. This systematic treatment was confirmed by Chabonnier *et al*. (2015) from a phylogenetic analysis. Breton *et al*. (2015) described *Meyeria houdardi* and *Meyeria* sp. from the Albian strata east of the Paris Basin and Pays de Bray. However, we consider that the specimens described by Breton *et al*. (2015, fig. 1A-G, p. 58) show morphological features in the carapace and pleon more similar to *Huhatanka* than to *Meyeria*. Recently, Robin *et al*. (2016) suggested that *Jabaloya aragonensis* Garassino *et al*. (2009) has morphological features similar to those of *Meyeria*. Including some morphological features which are

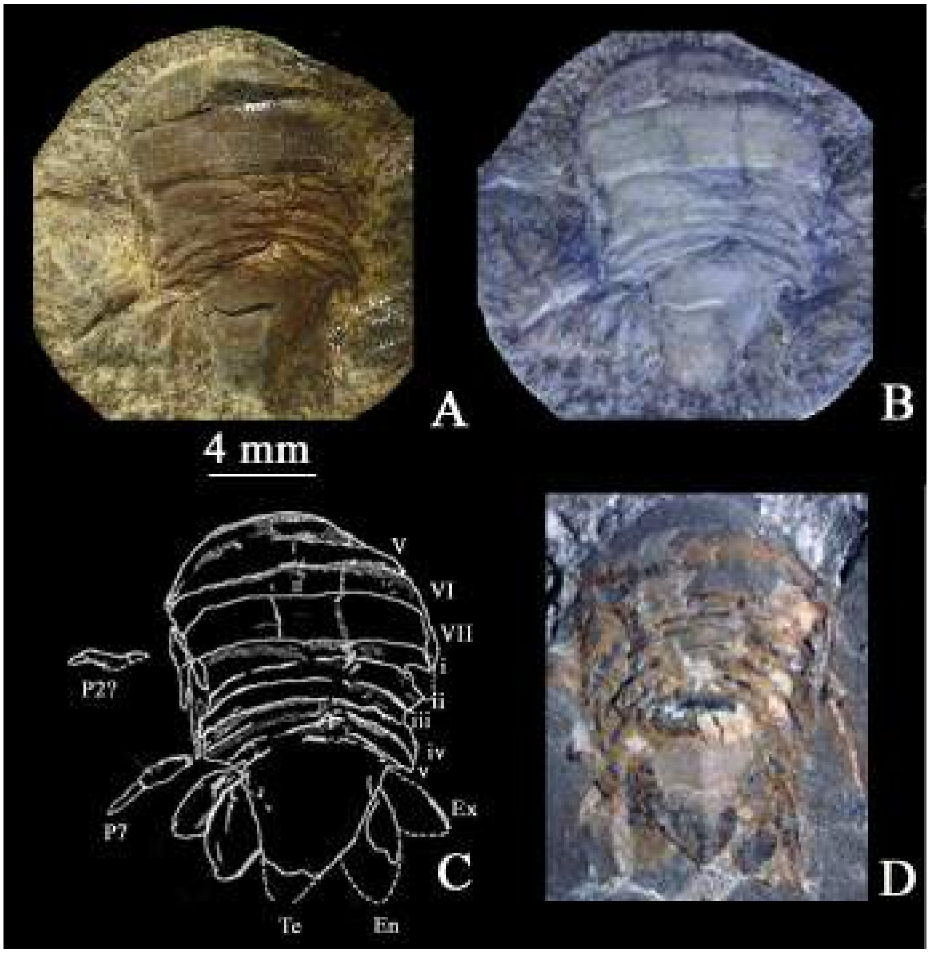

Figure 5 (A–C) Natatolana sp. (IUMC-100) from the late Albian in Central Iran. (A) Image, (B) inverted colour image, and (C) drawing of the almost complete posterior exuvia. (D) Comparison with posterior exuvia of Cirolana pueblaensis Vega and Bruce, 2019 in Vega et al., 2019, holotype IGM-11178, from the Early Cretaceous of Puebla, Mexico.

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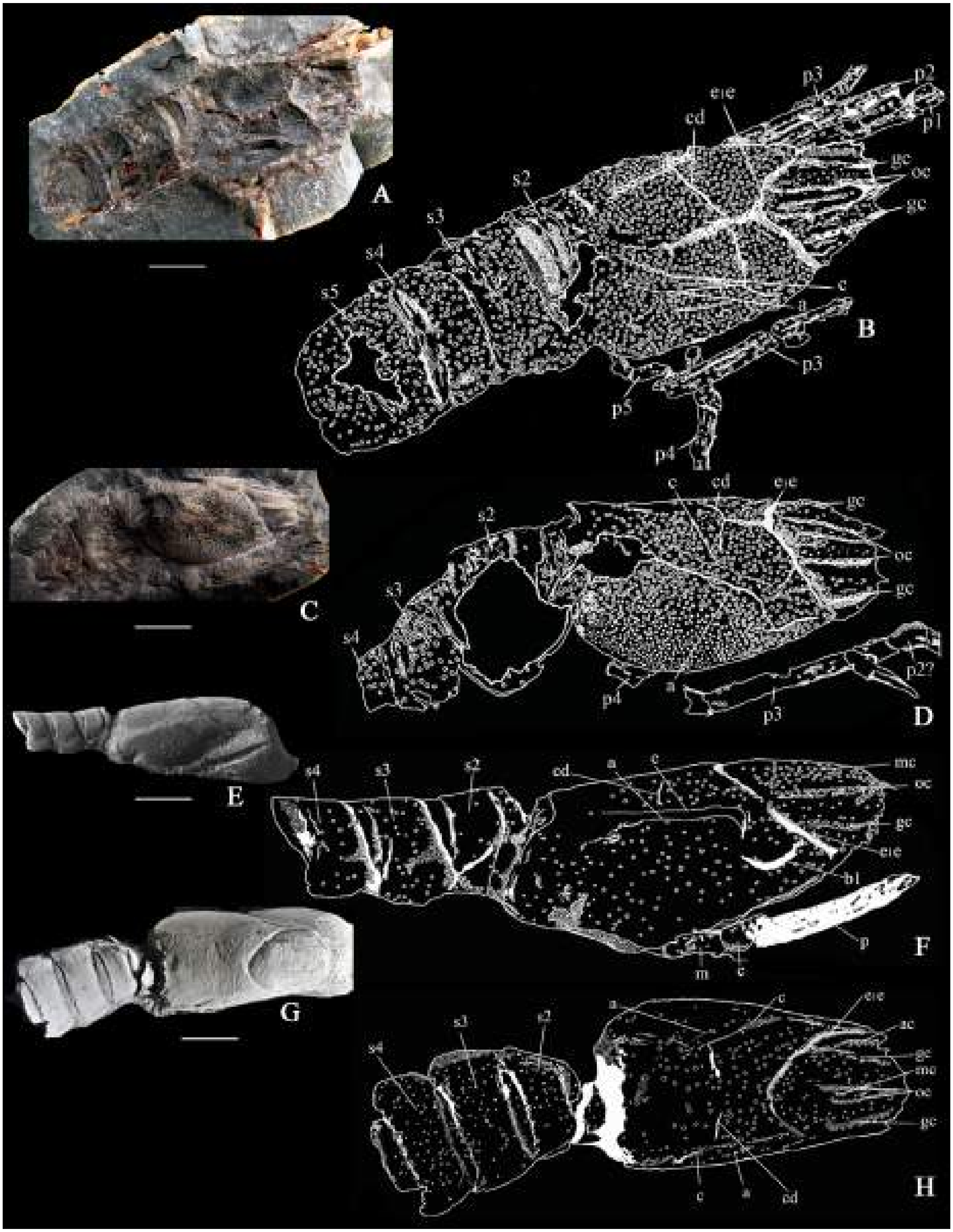

Figure 6 (A–D) Images and drawings of specimens of Huhatnka iranica Yazdi, Bahrami and Vega, 2010 from the Albian of Iran (IUMC 101 and IUMC-102). (E–H) Images and drawings of specimens of Huhatnka kiowana (Scott, 1970) from the Albian of Kiowa Formation, Kansas, USA (KSU 3768). Scale bars = 5 mm.

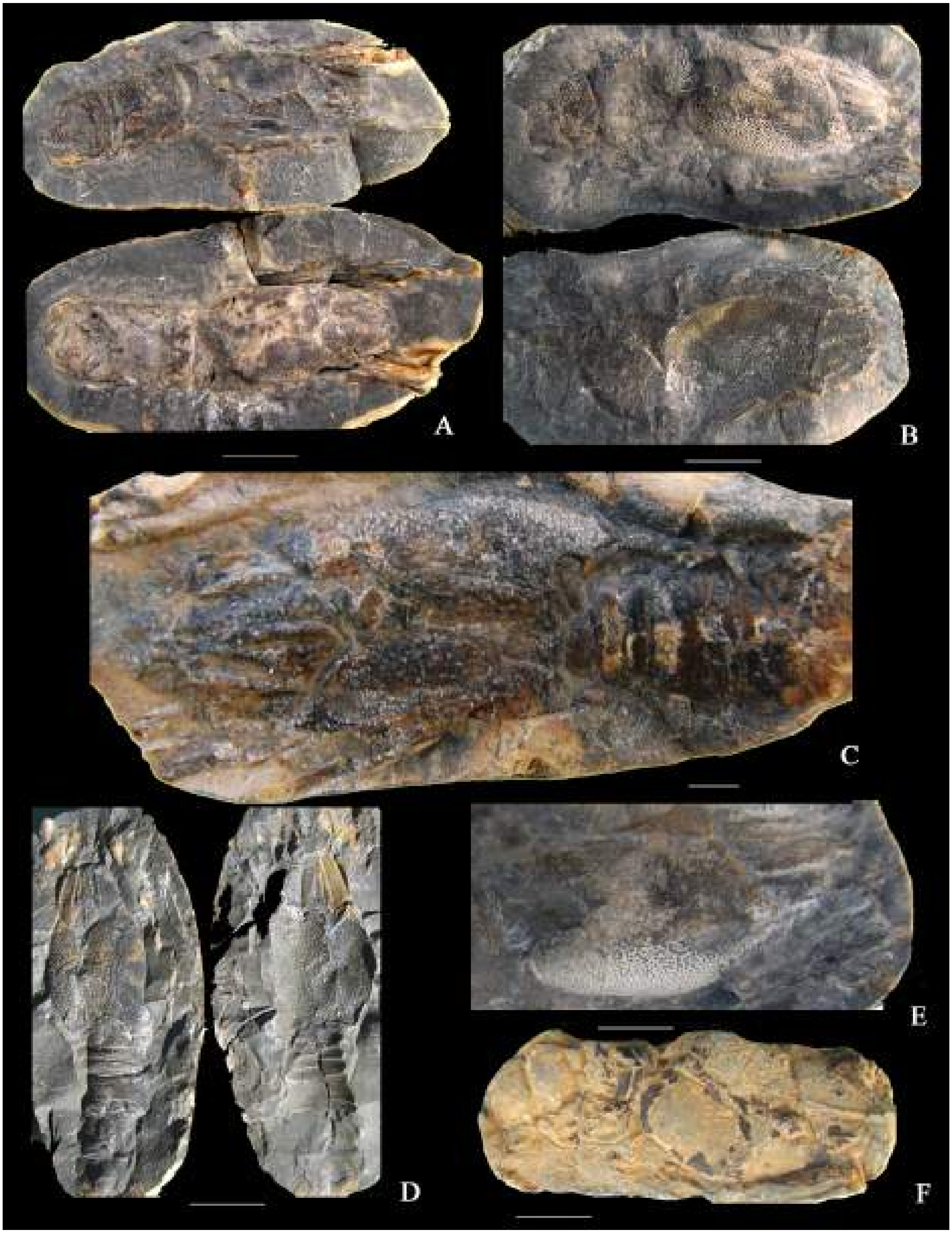

Figure 7 (A–F) Several specimens (part and counterpart) of Huhatnka iranica Yazdi, Bahrami and Vega, 2010 from the Albian of Iran (IUMC-101 to IUMC-105). Scale bars = 5 mm.

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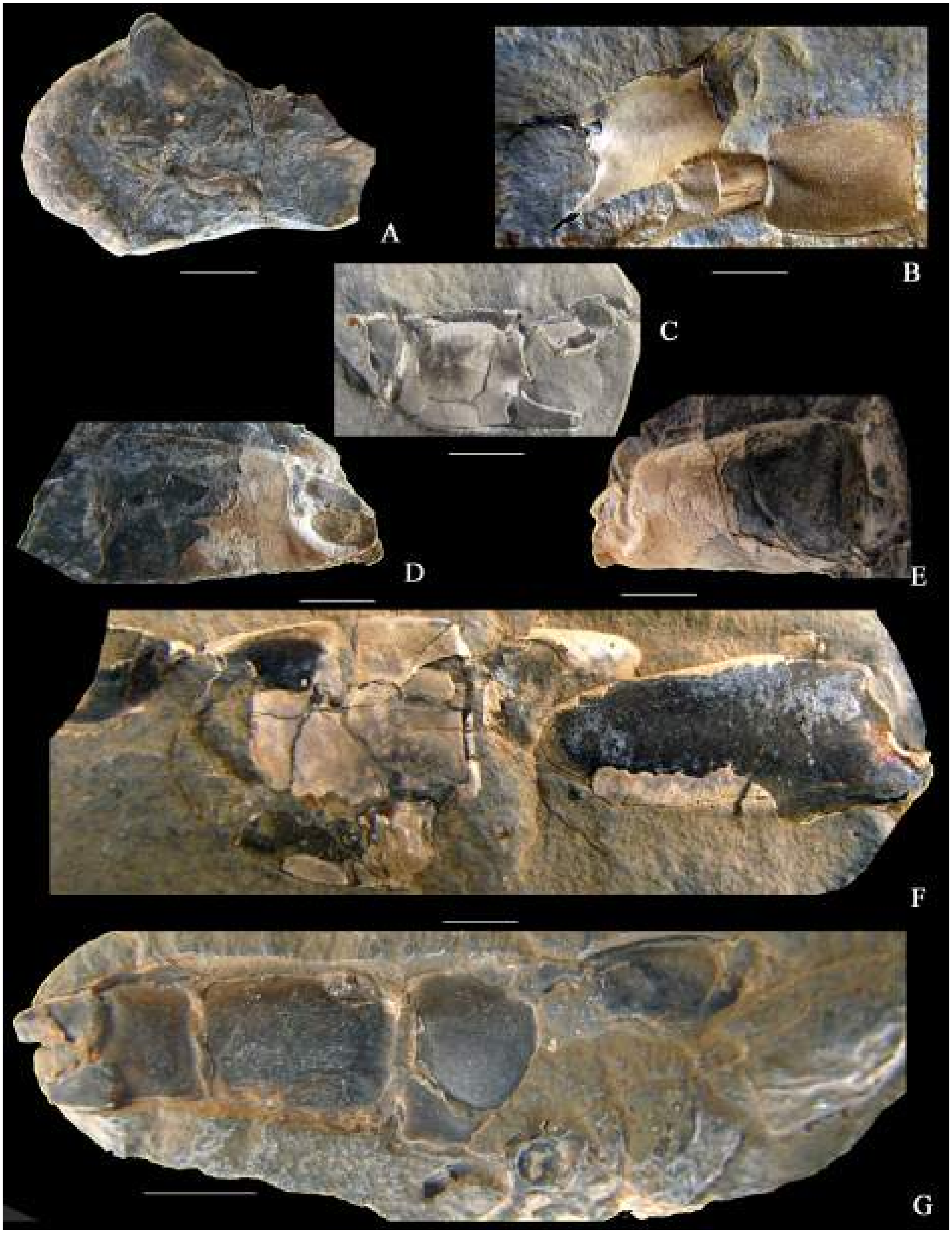

Figure 8 (A–G) Several indeterminate callianassoid specimens from the Albian of Iran (IUMC-106 to IUMC-111). Scale bars = 5 mm.

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absent or modified in *Meyeria* and *Mecochirus*, Robin *et al*. (2016) assigned the new genus *Atherfieldastacus* within the Mecochiridae, suggesting the new combinations *Atherfieldastacus magnus* (M'Coy, 1849), *A. mexicanus* (Rathbun, 1935), *A. rapax* (Harbort, 1905), and *A. schwartzi* (Kitchin, 1908) for these species previously assigned to *Meyeria.* Based upon this combination, González-León *et al*. (2014) considered that *Meyeria pueblaensis* should be a junior synonym of *Meyeria magna* (now *A. magnus*).

Infraorder Thalassinidea Latreille, 1831
Superfamily Callianassoidea Dana, 1852
Family Callianassidae Dana, 1852
Genus and species indet.
Figure 8

Description: Major cheliped one-third larger than minor cheliped; palm of major cheliped subrectangular, highest near junction with carpus, smooth; dactylus triangular, one-third the length of palm and its width one-fifth the maximum palm height. Merus of minor cheliped subovate, narrower at junction with carpus; carpus subrectangular, twice as high as long, posterior margin curved; palm subrectangular elongate, one-third longer than high; fixed finger triangular, half the length of palm and one-fourth its height.
Material: UIC 3762 to EUIC 3766.
Measurements: EUIC 3762 left cheliped (merus + carpus + palm) length = 36.2 mm, height = 10.3 mm; EUIC 3763 left chela (merus + carpus) length = 18.5 mm, height = 9.8 mm; EUIC 3764 right palm length = 16.4 mm, height = 9.6 mm; EUIC 3765 right palm length = 22.1 mm, height = 12.2 mm; EUIC 3766 left palm length = 19.4 mm, height = 11.5 mm.
Discussion: Yazdi *et al*. (2009) reported Callianassoidea palm remains from the Albian of Kolah Qazi section - *Beudanticeras* shale, Central Iran. It is possible that these callianassoid remains are similar to those herein reported, but only complete and better-preserved material could solve the systematic assignment of the specimens left in open nomenclature.

4. Conclusion

The new crustacean specimens collected from the Albian beds of Iran expand our knowledge of the crustacean assemblage of this region, including the first record of a fossil isopod. Aptian–Albian outcrops with concretions are potentially important for future findings, including potential new genera and species.

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